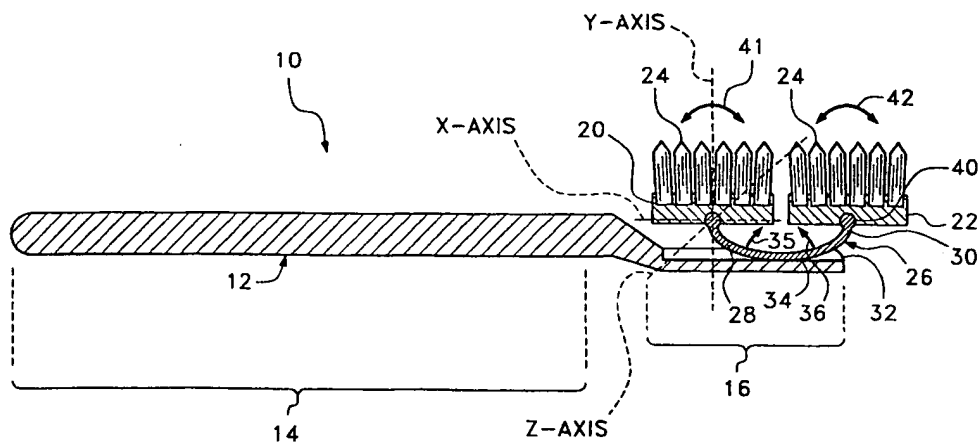


## INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

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**(54) Title:** TOOTHBRUSH DEVICE**(57) Abstract**

A toothbrush device (10) that conforms to the curvature and contours of the teeth while brushing. The toothbrush device includes a handle (12) for gripping. At least one bristle head (20,22) is disposed a predetermined distance from the handle. A support mechanism (26) is disposed between the handle and each of the bristle heads. The support mechanism varies the predetermined distance between the bristle heads and the handle as a function of a contact force applied to each of the bristle heads. A connection (40) is disposed between each support mechanism and each bristle head. The presence of the connection enables each bristle head to move in at least one plane in a manner independent of the support mechanism. This provides each of the bristle heads with the freedom of movement needed to properly conform to the curvature and contours of the teeth.

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TOOTHBRUSH DEVICETechnical Field Of The Invention

5           The present invention relates to toothbrushes that have a bristle head that is able to move independently of the toothbrush handle, thereby enabling the bristle head to better conform to the contours of the teeth during brushing.

10

Background Art

          The prior art is replete with different types and styles of toothbrushes that are used to brush the  
15       teeth and maintain proper oral hygiene. One of the most common types of toothbrush designs utilizes a single head of bristles that is permanently affixed in a set orientation at the end of a handle. Although the handle may have the ability to flex slightly, the  
20       movement of the bristle head directly corresponds to the movement of the handle.

          As is commonly known, most teeth are not flat, even, nor do they lay in a straight line. Rather, individual teeth are curved. Different teeth are  
25       different sizes and have different contours. Adjacent teeth do not always align. Rather, teeth are often crooked with different teeth leaning in different

directions. Lastly, teeth are set into the bones of the skull and jaw along generally semicircular paths. At different points along a row of teeth, the radius of curvature changes, depending upon the size of the mouth, the number of teeth and the orientation of the teeth. The area within the mouth with the smallest radius of curvature is typically the area on the tongue side of the teeth behind the central and lateral incisors.

Utilizing a traditional toothbrush where the bristle head is set in one position, it is nearly impossible to manipulate the bristle head properly to cause the bristle head to brush against all surfaces of the teeth. Recognizing the flaws in the design of traditional toothbrushes, alternative designs have been produced. The purpose of the alternative designs is to increase contact between the bristle head and the teeth, thereby increasing the efficiency of the brushing action.

U.S. Patent No. 5,228,166 to Gomez, entitled Removable Pivotal Head Toothbrush, exemplifies prior art toothbrush devices that have a bristle head that is pivotably connected to the toothbrush handle. In such prior art designs, the bristle head is able to pivot in line with the handle. This helps the bristle head better move across the teeth. One of the problems

associated with such prior art toothbrush designs is that the single large bristle head prevents the bristles from conforming to the teeth on areas where the position of the teeth curve sharply. Furthermore,  
5 the single plane of movement provided by the pivot does not assist the bristle head in conforming to crooked teeth or teeth that do not otherwise conform to the vertical.

U.S. Patent No. 5,398,366 to Bradley, entitled  
10 Rocker Toothbrush, exemplifies toothbrush designs where the bristle heads are pivoted to move in planes that are perpendicular to the line of the toothbrush handle. A problem associated with such tooth brush designs is that the pivoting movement of the bristle  
15 heads do not help the bristle conform to the teeth in areas having a small radius of curvature, such as behind the lateral and central incisors.

U.S. Patent No. 5,499,421 to Brice, entitled  
20 Twin-Headed Toothbrush exemplifies prior art toothbrush designs where different bristle heads are supported by different elements that extend from the handle. In such tooth brush designs, the bristle heads are side-by-side. Accordingly, the bristle heads have the same difficulty in conforming to areas of the  
25 teeth with small radii of curvature as do tradition toothbrushes with single set bristle heads.

A need therefore exists in the prior art for a toothbrush design that is capable of having bristle heads conform to the teeth in areas where the teeth are arranged with a small radius of curvature and in  
5 situations where the teeth may be of different sizes and misaligned. This need is met by the present invention as described and claimed below.

#### Disclosure Of The Invention

10 The present invention is a toothbrush device that conforms to the curvatures and contours of the teeth while brushing. The toothbrush device includes a handle for gripping. At least one bristle head is disposed a predetermined distance from the handle. A  
15 support mechanism is disposed between the handle and each of the bristle heads. The support mechanism varies the predetermined distance between the bristle heads and the handle as a function of a contact force applied to each of the bristle heads. A connection is  
20 disposed between each support mechanism and each bristle head. The presence of the connection enables each bristle head to move in at least one plane in a manner independent of the support mechanism. This provides each of the bristle heads with the freedom of  
25 movement needed to properly conform to the curvature and contours of the teeth.

BRIEF DESCRIPTION OF THE DRAWINGS

For a better understanding of the present invention, reference is made to the following  
5 description of exemplary embodiments thereof, considered in conjunction with the accompanying drawings, in which:

FIG. 1 is a cross-sectional view of an exemplary  
10 toothbrush device in accordance with the present invention;

FIG. 2 is a top view of the bristle head section of the embodiment of the toothbrush device shown in  
15 Fig. 1;

Fig. 3 is a end side view of the bristle head section of the embodiment of the toothbrush device shown in Fig. 1;

20

Fig. 4 is a perspective view of the embodiment of the toothbrush device shown in Fig. 1, shown in conjunction with a fragmented mouth to expose the teeth within the mouth;

25

Fig. 5 is a perspective view of the bristle head

section of an alternate embodiment of a toothbrush device in accordance with the present invention;

Fig. 6 is a side view of a second alternative  
5 embodiment of a toothbrush device in accordance with the present invention;

Fig. 7 is a side view of a third alternative  
embodiment of a toothbrush device in accordance with  
10 the present invention; and

Fig. 8 is a side view of a fourth alternative  
embodiment of a toothbrush device in accordance with  
the present invention.

15

#### Best Mode Of Carrying Out The Invention

Although the present invention device can be used  
in conjunction with any brush system, such as cleaning  
brushes and the like, the present invention device is  
20 especially suitable for use in the field of  
toothbrushes. As a result, the exemplary embodiments  
of the present invention device will all illustrate  
the present invention device configured as a  
toothbrush in order to set forth the best mode  
25 contemplated for the invention.

Referring to Fig. 1, an exemplary embodiment of a



toothbrush device 10 is shown in accordance with the present invention. The toothbrush device 10 includes a handle 12. In the shown embodiment, the handle 12 includes an elongated gripable section 14 and a head support section 16. Although the gripable section 14 and the head support section 16 of the handle 12 can each be linearly aligned, in the shown embodiment the head support section 16 is positioned slightly off-center from the longitudinal axis of the gripable section 14.

The toothbrush device 10 includes a plurality of bristle heads. In Fig. 1, two bristle heads 20, 22 are shown by way of example. Each of the bristle heads 20, 22 supports a matrix of bristles 24 that extend from each bristle head 20, 22. The bristles 24 can have many different configurations and may terminate in a common plane or in a contoured configuration. Different bristle patterns and contours are well known in the prior art.

An arm support 26 is disposed between the head support section 16 of the handle 12 and the bristle heads 20, 22. The arm support 26 is a generally U-shaped structure having a first arm element 28 and a second arm element 30 that extend upwardly. The first shown bristle head 20 is connected to the first arm element 28. Similarly, the second shown bristle head

22 is connected to the second arm element 26.

A slot 32 is disposed in the head support section 16 of the handle 12 below the bristle heads 20, 22. The bottom center of the arm support 26 is connected to the head support section 16 of the handle 12 with a pivot 34 within the slot. Consequently, both the first arm element 28 and the second arm element 30 are free to rotate about the pivot 34 in the directions of arrows 35 and 36, within the confines of the slot 32. The axis of the pivot 34 is perpendicular to the longitudinal axis of the slot 32 and the head support section 16 of the handle 12.

As the arm support 26 rotates about the pivot 34, the height of the top end of both the first arm element 28 and the second arm element 30 changes with respect to the handle 12. At least part of an articulated coupling 40 is disposed at the top end of each arm element 28, 30. The articulated coupling 40 interconnects the each arm element 28, 30 to the corresponding bristle head 20, 22. In Fig. 1, a reference guide of an X, Y and Z axis is shown. The origin of the reference guide should be considered at the top end of each arm element 28, 30. An articulated coupling 40 is any coupling that would enable the bristle heads 20, 22 to at least partially rotate about the X-axis, the Y-axis and the Z-axis. In the

shown embodiment, the articulated coupling 40 is a ball and socket joint, wherein the ball is disposed at the top end of each arm element 28, 30 and the socket is disposed in the bottom of each bristle head 20, 22.

5 In alternative embodiments, hinge arrangements can be used. Similarly, a segment of elastomeric material or a spring element can also be positioned between the arm elements 28, 30 and bristle heads 20, 22, wherein the elastomeric material or spring acts as the

10 articulated coupling by allowing deformation in all directions.

From Fig. 1, it is clear that the arm elements 28, 30 enable each of the bristle heads 20, 22 to move in the directions of arrows 41 and 42, respectively.

15 Referring now to Fig. 2, it can be seen that the articulated coupling 40 (Fig. 1) between each arm element 28, 30 (Fig. 1) and each bristle head 20, 22 enables the bristle heads 20, 22 to rotate about the point of the articulated coupling on the directions of

20 arrows 43 and 44, respectively. Similarly, by referring to Fig. 3, it can be seen that the articulated coupling 40 between each arm element and each bristle head 20, 22 enables the bristle heads 20, 22 to rotate about the point of the articulated

25 coupling 40 in the directions of arrows 45 and 46, respectively.

Returning to Fig. 1, it should therefore be understood that the arm elements 28, 30 enable the bristle heads 20, 22 to move independently up and down in the Y-axis. Simultaneously, the articulated  
5 coupling 40 between the arm elements 28, 30 and the bristle heads 20, 22 enable the bristle heads 20, 22 to pitch, roll and yaw about the X-axis, the Y-axis and the Z-axis, respectively.

Referring to Fig. 4, it can be seen that the  
10 multiple degrees of freedom in motion provided to the bristle heads 20, 22 by the arm elements 28, 30 and the articulated coupling 40 enable the bristle heads 20, 22 to conform to the contour of the mouth even in areas having a small radius of curvature. This enables  
15 the bristles 24 to maintain good contact with the teeth regardless to the position or orientation of the teeth in the mouth.

In the embodiment of Figures 1-4, the bristle heads 20, 22 were connected to the arm elements 28, 30  
20 by a ball and socket joint. It will be understood that such a joint can be made with a snap fit, wherein the bristle heads 20, 22 can be selectively separated from the arm elements 28, 30. The ability to selectively connect and disconnect the bristle heads 20, 22 enable  
25 the bristle heads 20, 22 to be easily replaced when worn without having to replace the remainder of the

toothbrush device 10.

Referring to Fig. 5, an alternate embodiment of a toothbrush device 100 is shown in accordance with the present invention. In this embodiment, the head support section of the handle 16, the slot 32, the arm support 26, arm elements 28, 30 and the pivot connection 34 between the head support region 16 and the arm support 26 are the same as with the initial embodiment. For this reason, the elements are identified with the same reference numerals as were used with the initial embodiment.

In the embodiment of Fig. 5, the two bristle heads 102, 104 are joined together at one end to create an overall bristle head assembly 106. In the embodiment shown, a hinge connection 108 is used to join the two bristle heads 102, 104. However, it will be understood that other connections can be used such as an elastomeric material joint or a thinned flexible plastic joint. Regardless of the connection used, it should be understood that the center of the bristle head assembly 106 is free to move up and down in the directions of arrow 110, thereby selectively changing the slope associated with each of the bristle heads 102, 104.

The top ends of the arm elements 28, 30 below the

bristle heads 102, 104 no longer terminate with fully articulated connections. Rather, in the embodiment of Fig. 5, less free interconnection elements are used. As is shown, the top end of the second arm element 30  
5 is pivotably connected to the bottom of the second bristle head 104. This enables the second bristle head 104 to turn about the pivot connection 112 in the same plane as length of the toothbrush handle 12. However, since the second bristle head 104 is pivotably  
10 connected to the first bristle head 102, any movement in the second bristle head 104 will cause movement in the first bristle head 102.

The arm elements 28, 30 enable each of the bristle heads 102, 104 to move up and down  
15 independently of the other. Accordingly, each side of the bristle head assembly 106 can move up and down independently. In order to allow for the two bristle heads 102, 104 to move up and down independently and for the second bristle head 104 to pivot about the top  
20 of the second arm element 30, the interconnection between the first arm element 28 and the first bristle head 102 can not be laterally static. Rather, in the shown embodiment, the top end of the first arm element 28 connects to the center of the first bristle head  
25 102 with a sliding pivot arrangement 114. The sliding pivot arrangement 114 includes a slotted track 116. A

pivot pin 118 rides within the slotted track 116,  
wherein the pivot pin 118 is attached to the top of  
the first arm element 28.

5 The use of the arm elements 28, 30 as well as the  
pivot connections between the bristle head assembly  
106 and the arm elements 28, 30, enable the bristle  
head assembly 106 to conform to either a concave  
orientation or a convex orientation. In either  
orientation, the radius of curvature to which the  
10 bristle heads 102, 104 conform can be varied within a  
wide range. Once in a particular radius of curvature,  
the entire bristle head assembly 106 can rotate about  
the pivot 34 of the arm support 26. Accordingly, the  
bristle head assembly 106 can be configured to either  
15 the outside of the teeth or the inside of the teeth  
and can be moved along the teeth while maintaining  
contact between the bristles and the teeth.

Referring to Fig. 6. a slight modification of the  
toothbrush device of Fig. 5 is shown. In this  
20 embodiment, separate bristle heads are not used.  
Rather, the toothbrush device 150 has a single bristle  
head 152 fabricated from an elastomeric material. The  
bristles 154 are set into the material of the bristle  
head 152. Since the bristle head 152 is made from  
25 elastomeric material, the bristle head 152 is free to  
bend across its entire length. Accordingly, the

bristle head 152 can conform to curved surfaces better than can rigid bristle heads. The flexible bristle head 152 can be attached to the handle utilizing and support and connector assembly previously of  
5 subsequently described.

Referring to Fig. 7, a third alternative embodiment of a toothbrush device 200 is shown in accordance with the present invention. In this embodiment, the two flexible arms 202, 204 are used to  
10 support the two bristle heads 206, 208. The arms 202, 204 are flexible and enable the two bristle heads 206, 208 to move independently up and down in the directions of arrow 210 and back and forth in the plane of the paper. The flexible arms 202, 204 can  
15 connect to the bristle heads 206, 208 with articulated connections 212 as is shown and was previously described. Alternatively, the arms can connect to the bristle heads with the pivot connections illustrated and described in connection with Fig. 5.

Referring to Fig. 8, a fourth alternate embodiment of a toothbrush device 300 is shown. In this embodiment, the two bristle heads 302, 304 are supported by spring elements 306. The spring elements  
20 306 allow the bristle heads to move independently up and down. Furthermore, the spring elements 306 enable  
25 each of the bristle heads 302, 304 to independently



pitch, roll and yaw in order to conform to the shape and contour of a person's teeth. Accordingly, the spring element take the place of flexible arm supports with articulated connections.

5           It will be understood that the embodiments of the present invention described and illustrated herein are merely exemplary and a person skilled in the art can make many variations to the embodiment shown without departing from the scope of the present invention. It  
10           should also be understood that the various elements from the different embodiments shown can be mixed together to create alternate embodiments that are not specifically described. All such variations, modifications and alternate embodiments are intended  
15           to be included within the scope of the present invention as defined by the appended claims.

CLAIMS

1. A toothbrush device, comprising:  
a handle;  
at least one bristle head disposed a  
predetermined distance from said handle;  
5 a support mechanism disposed between said  
handle and said at least one bristle head for varying  
said predetermined distance as a function of a contact  
force applied to said at least one bristle head; and  
a connection disposed between said support  
10 mechanism and each said at least one bristle head that  
enables said at least one bristle head to move in at  
least one plane independent of said support mechanism.
2. The device according to Claim 1, wherein  
said at least one bristle head is configured to  
include a plurality of bristle heads.
3. The device according to Claim 1, wherein  
each of said plurality of bristle heads are  
interconnected by at least one flexible connection.
4. The device according to Claim 1, wherein  
said support mechanism includes at least one arm  
element pivotably connected to said handle.

5. The device according to Claim 1, wherein said support mechanism includes at least one spring element.

6. The device according to Claim 1, wherein said connection is a pivoted connection.

7. The device according to Claim 1, wherein said connection is a ball and socket joint.

8. The device according to Claim 1, further including a segment of deformable material disposed between said at least one bristle head and said support mechanism, wherein said segment of deformable material forms said connector.

9. The device according to Claim 1, wherein said at least one bristle head includes a first bristle head and a second bristle head.

10. The device according to Claim 9, wherein said support arm includes a first arm element that supports said first bristle head and a second arm element that supports said second bristle head.

11. The device according to Claim 10, wherein

said first arm element and said second arm element are interconnected and join to said handle at a common pivot point.

12. The device according to Claim 10 wherein said connection between said first arm element and said first bristle head is a sliding pivot connection and said connection between said second arm element and said second bristle head is a pivot connection.

13. The device according to Claim 10, wherein said first arm element and said second arm element are flexible and extend from said handle.

14. The device according to Claim 9, wherein said first bristle head and said second bristle head each have two short sides and two long sides and said first bristle head and said second bristle head are linearly aligned with the short side of each facing the other.

15. The device according to Claim 1, wherein said at least one bristle head is flexible.

16. A toothbrush device, comprising:  
a handle;

a bristle head assembly having a first bristle head coupled to second bristle head with a pivotable connection, wherein a slope associated with each said first bristle head and said second bristle head can be independently varied;

an arm support having a first end, a second end and a middle section disposed between said first end and said second end, wherein said first end is coupled to said first bristle head, said second end is coupled to said second bristle head and said middle section is pivotable connected to said handle.

17. The device according to Claim 16, wherein said second end of said arm support is pivotably connected to said second bristle head.

18. The device according to Claim 17, wherein said first end of said arm support is coupled to said first bristle head with sliding pivot arrangement.

19. A toothbrush device, comprising:  
a handle;  
a plurality of bristle heads;  
a plurality of flexible arms extending from said handle, wherein each of said plurality of flexible arms supports one of said bristle heads;

a connector disposed between each of said flexible arms and each of said bristle heads that enable each of said bristle heads to move in at least one plane independently of a flexible arm in support thereof.

20. The device according to Claim 19, wherein said connector includes a ball and socket joint.

1/7

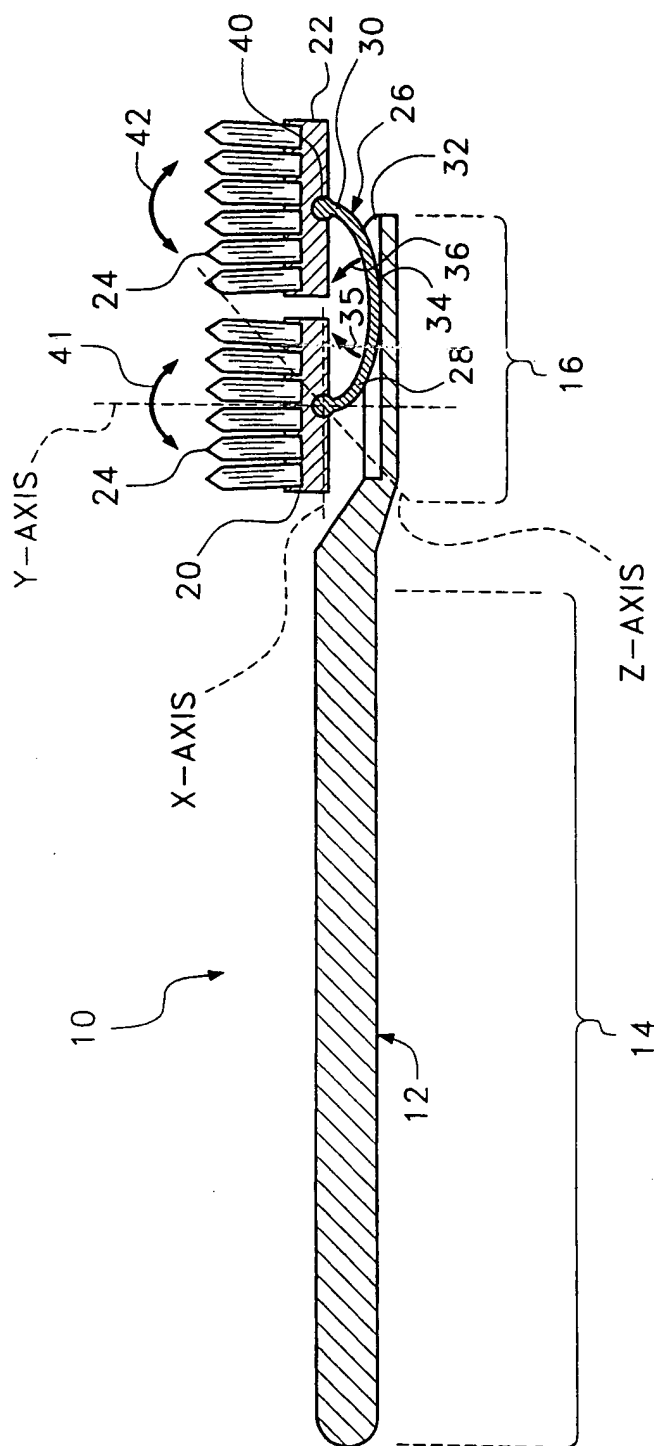


Fig. 1

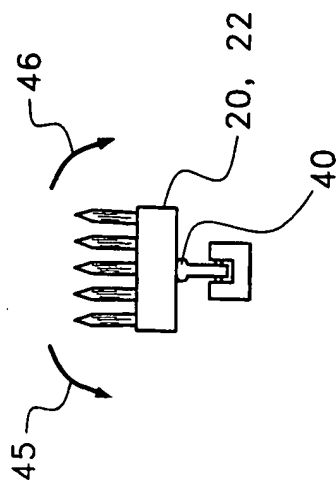


Fig. 3

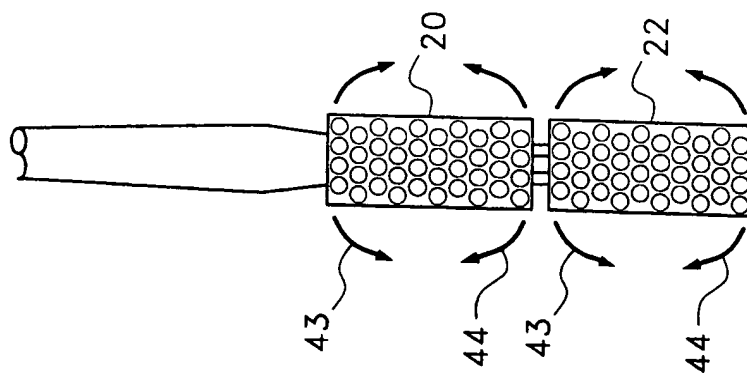
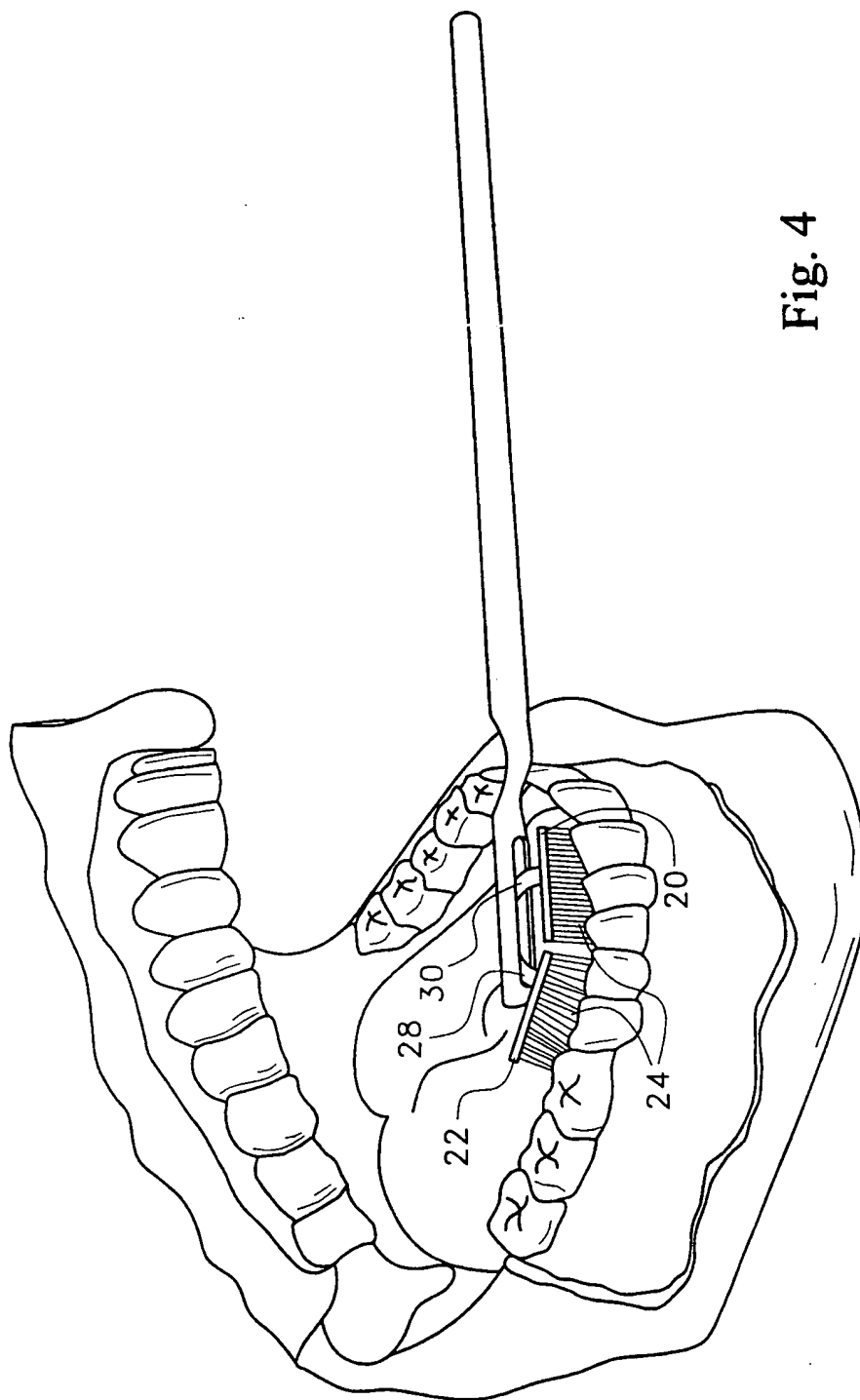


Fig. 2



3/7

Fig. 4



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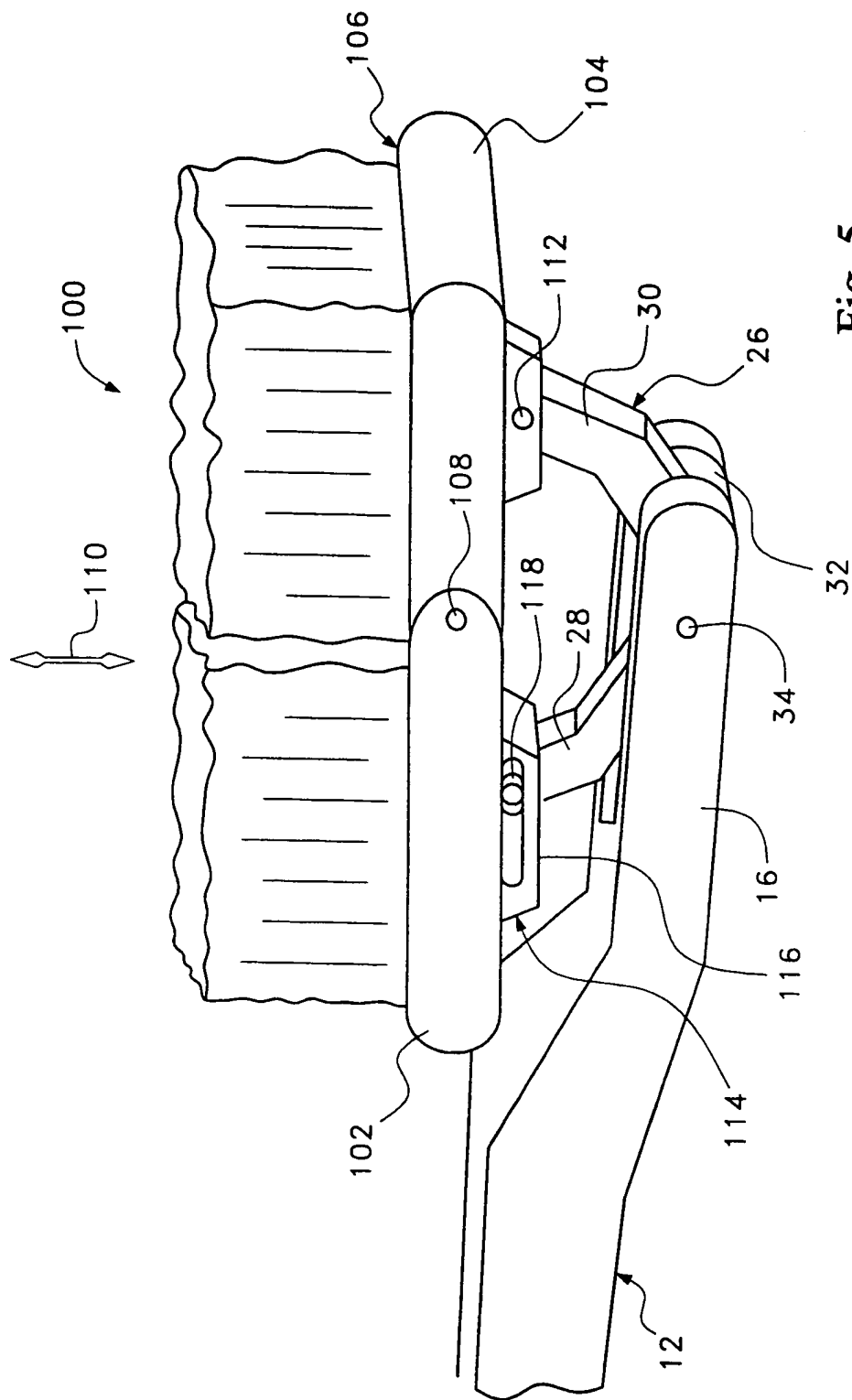


Fig. 5

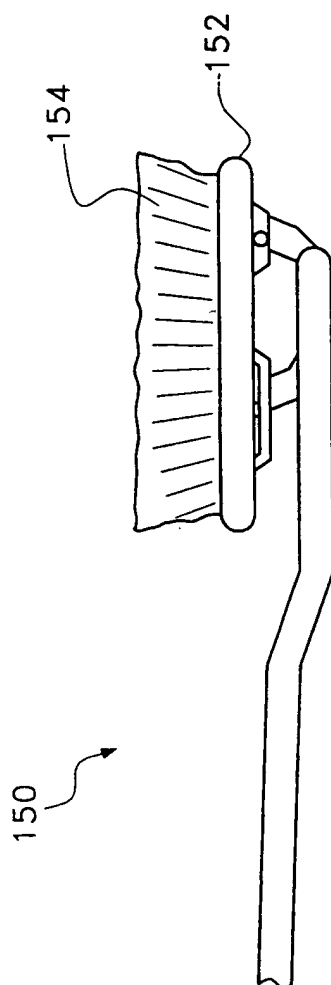


Fig. 6

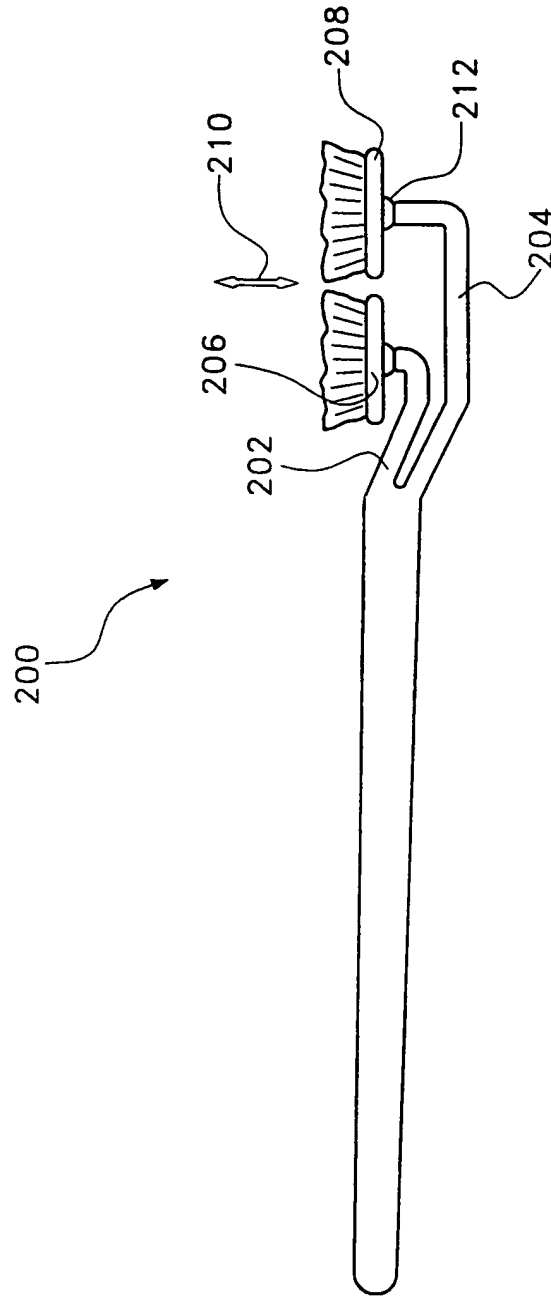


Fig. 7

7/7

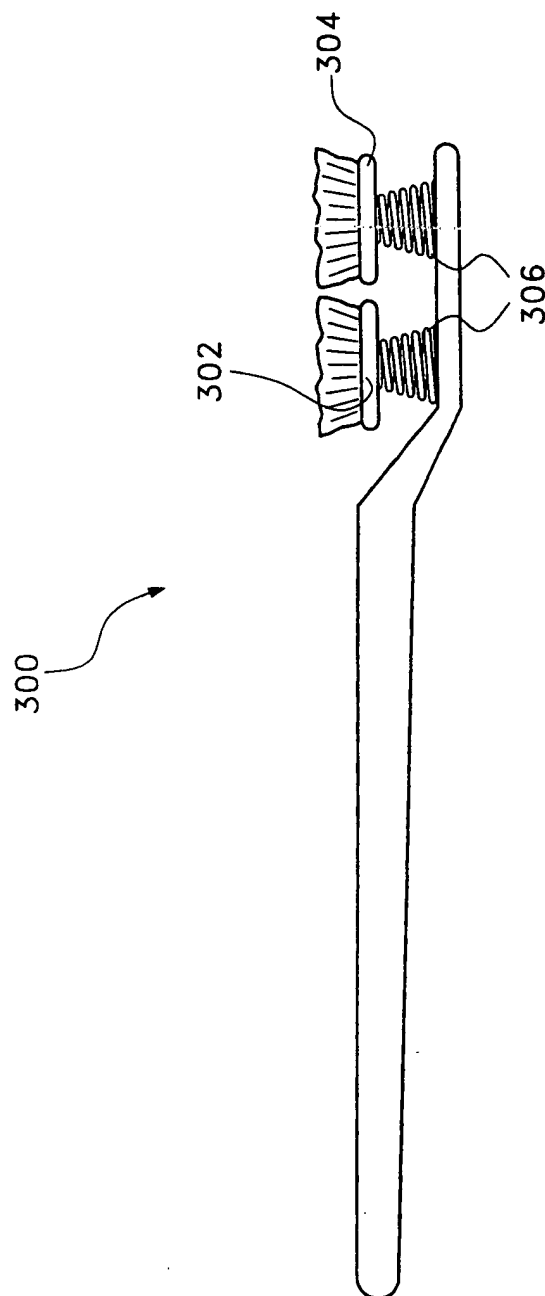


Fig. 8

## INTERNATIONAL SEARCH REPORT

International application No.  
PCT/US99/01650

## A. CLASSIFICATION OF SUBJECT MATTER

IPC(6) :A46B 9/04  
US CL :15/167.1, 172

According to International Patent Classification (IPC) or to both national classification and IPC

## B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

U.S. : 15/167.1, 172

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched  
NONE

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)  
NONE

## C. DOCUMENTS CONSIDERED TO BE RELEVANT

| Category* | Citation of document, with indication, where appropriate, of the relevant passages | Relevant to claim No. |
|-----------|--|-----------------------|
| X         | US 4,317,463 A (MASSETTI) 02 March 1982 (02-03-82), see entire document.           | 1,2,4,6,9-11          |
| X         | US 4,333,199 A (DEL ROSARIO) 08 June 1982 (08-06-82), see entire document.         | 1,5                   |
| A         | US 1,369,664 A (IZAWA) 22 February 1921 (22-02-21), see entire document.           | 1-20                  |
| A         | US 1,894,509 A (BOOTH) 17 January 1933 (17-01-33), see entire document.            | 1-20                  |
| A         | US 2,266,195 A (HALLOCK) 16 December 1941 (16-12-41), see entire document.         | 1-20                  |
| A         | US 2,685,703 A (DELLENBACH) 10 August 1954 (10-08-54), see entire document.        | 1-20                  |



Further documents are listed in the continuation of Box C.



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Date of the actual completion of the international search

05 MARCH 1999

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24 MAR 1999

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## C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

| Category* | Citation of document, with indication, where appropriate, of the relevant passages | Relevant to claim No. |
|-----------|--|-----------------------|
| A         | US 3,065,479 A (MCGEE) 27 November 1962 (27-11-62), see entire document.           | 1-20                  |
| A         | US 3,398,421 A (RASHBAUM) 27 August 1968 (27-08-68), see entire document.          | 1-20                  |
| A         | US 4,691,405 A (REED) 08 September 1987 (08-09-87), see entire document.           | 1-20                  |
| A,P       | US 5,758,383 A (HOHLBEIN) 02 June 1998 (02-06-98), see entire document.            | 1-20                  |

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